ONTARIO

Ministry of the ENVIRONMENT

Bottom Fauna Survey of Long Point Bay in the Nanticoke Region 1969

BOTTOM FAUNA SURVEY OF LONG POINT BAY

IN THE NANTICOKE REGION

1969

by
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INTRODUCTION

As a result of proposals for extensive industrial development concentrated in the Nanticoke area, the pre-operative collection of biological water quality data was initiated by the Biology Branch of the OWRC early in the spring of 1969. These biological studies, encompassing bottom fauna and phytoplankton evaluations, were designed to complement additional field investigations by the Water Quality Surveys Branch of the Commission, the Steel Company of Canada and the Hydro Electric Power Commission which were established to define physico-chemical characteristics, as well as zooplankton assessments carried out by the Department of Lands and Forests.

This report is limited to the bottom fauna portion of the survey work carried out in 1969. Publication of the phytoplankton data will follow at a later date.

DEVELOPMENT AT NANTICOKE

Industries locating in the Nanticoke area include the Steel Company of Canada (Stelco), Texaco Canada Ltd., and the Hydro Electric Power Commission. The fossil-fuelled Nanticoke Generating Station will have a 4,000,000 kilowatt capacity upon completion in November, 1974. The

first of eight generating units will commence operation in June, 1972. Approximately 2.16 Mgpm of cooling water will be discharged at a temperature elevated 15°F above the background lake condition. Texaco Canada Ltd. will commence construction of its 50,000-barrel-per-day refinery in the winter of 1970 and anticipates completion by the fall of 1972. The refinery could be expanded to an ultimate production capacity of 100,000 barrels per day. Process water containing an estimated 15 ppb phenol, 5 ppm oil and .7 ppm ammonia will be discharged at a rate of 500 gpm. At present, plans for the steel refinery proposed by Stelco have been postponed indefinitely. The plant was to have produced 3.8 million tons of steel per year.

BIOLOGICAL ASSESSMENT OF WATER QUALITY

A study of bottom fauna associations not only reveals the effect of waste discharges on important fish-food organisms but also indicates the quality of the aquatic environment over extended time intervals. Benthic populations are virtually sedentary (unlike fish) and are less prone to exhibit diurnal and seasonal variations of the same magnitude as phytoplankton and zooplankton populations.

To assess environmental quality, a comparison of variety and total numbers of bottom fauna organisms at strategically located sampling sites is utilized. A clean-water association is usually characterized by a wide variety

of species with no outstanding numerical abundance of one group. When subjected to toxic wastes or adverse environmental conditions, benthic associations may become markedly depressed in both numbers and variety.

METHODS

Owing to the rocky nature of the bottom which precluded the collection of benthic organisms by dredging, artificial substrates were employed to monitor benthic populations. These rock-filled cages provide a common substrate for habitation by organisms indigenous to the area over a suitable exposure period.

Commencing on April 28, two artificial substrate samplers were placed at each of eight stations which had been selected to reflect the effects of varying water quality conditions throughout the area. At approximate six-week intervals these samplers were recovered, the macroinvertebrates were collected and the substrates replaced. During the collection process, each stone was scrubbed to insure that all organisms were removed and that any organic accumulation (including algal growth) was eliminated.

Specimens were separated, preserved in 95% ethanol and returned to the London Laboratory for identification and enumeration.

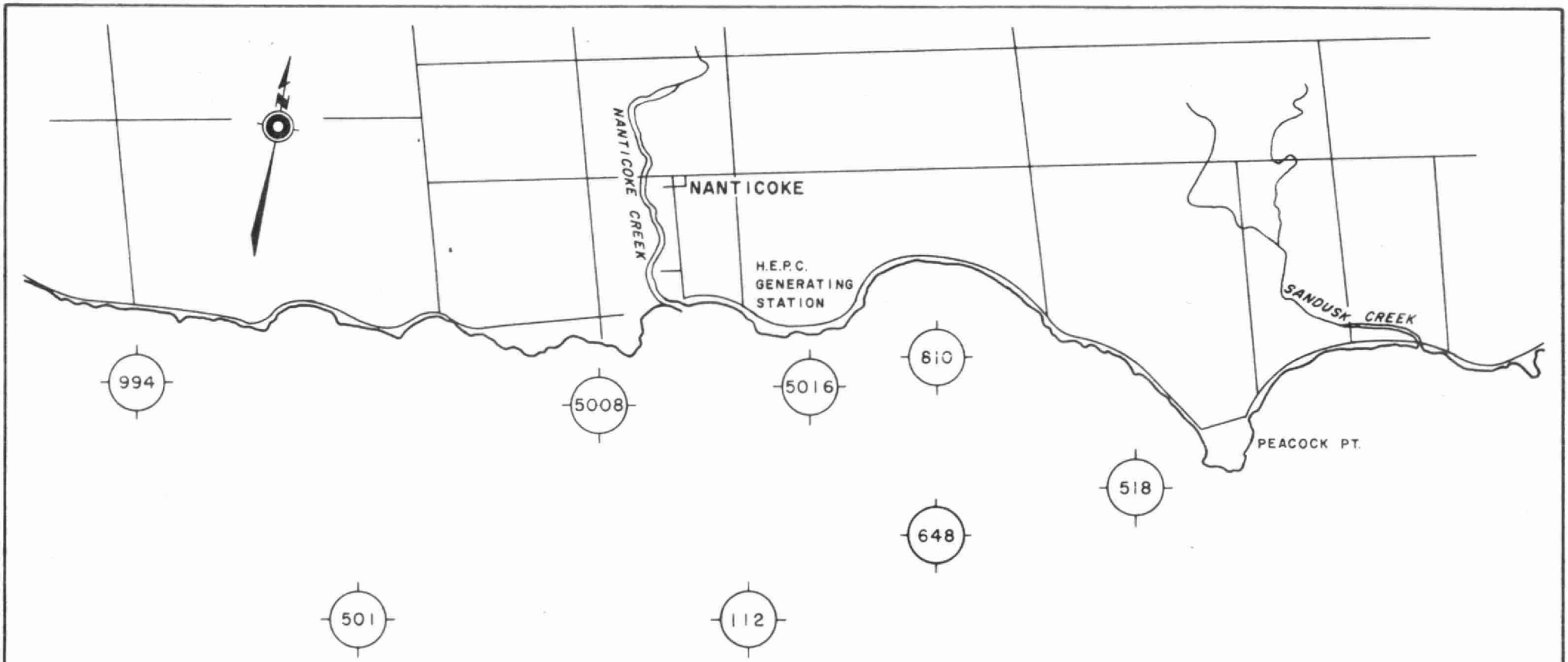

FIGURE 1

ONTARIO WATER RESOURCES COMMISSION	
NANTICOKE AREA STATION LOCATIONS – 1969	
SCALE: 1/2 0 1 STATUTE MILES	
DRAWN BY: A.R.S.	DATE: APRIL, 1970
CHECKED BY:	DRAWING Nº: 70-67-GL

RESULTS

Data for sixty-two of the sixty-four samplers are included in Appendix I. Information is lacking for the June collection at Station 5016 as a result of misplacement of samples. Numbers of organisms from the two samplers at each station were averaged for each sampling run.

General

The number of different macroinvertebrate taxa collected from the eight stations in 1969 totalled 31. Considering each station individually, the number of taxa ranged from 15 (station 648) to 20 (stations 810 and 501) over the year. Mayflies, caddisflies, crayfish, flatworms and a single species of fish (sculpins) comprised ten taxa which occurred at 100 percent of the stations (Table I).

Table I - Percentage occurrence of organisms at eight stations in the Nanticoke region (1969).

%	(Number of Stations)	Taxa
100	(8)	Stenonema spp., Polycentropus, Cryptochironomus, Gammarus, Orconectes, Bulimus, Goniobasis, Physa, Planariidae, Cottus sp.
88	(7)	Asellus, Amnicola
75	(6)	Stenonema tripunctatum, Sphaerium
50	(4)	Cambarus robustus, Helisoma
38	(3)	Athripsodes, Crangonyx, Pisidium, Glossiphonia
25	(2)	Ephemerella, Dicrotendipes, Microtendipes, Lirceus
13	(1)	Stenelmis, Tanytarsus, Hyallela, Pontoporeia, Somatogyrus, Valvata tricarinata, Helobdella, Limnodrilus

The annual average number of organisms per station was 259 ranging from 53 (station 648) to 833 (station 5016). Five of the eight stations fell within the 150 to 200 range.

Seasonal Variation

Both abundance and variety of organisms varied seasonally (Table 2). Monthly average numbers of organisms per station were highest in June (410 organisms per station) and lowest in August (99 organisms per station). At six out of seven *stations, the greatest numbers occurred in June, while at four out of the eight stations, August ranked lowest in abundance (Table 3).

Table 2 - Seasonal variation in average numbers of taxa and organisms at eight stations in the vicinity of Nanticoke (1969).

Sample Period	Avg. No. Taxa per station	Avg. No. Organisms per station
June	10.3	410
August	9.0	99
September	12.3	264
October	11.6	211

August also ranked last in variety at six of the eight stations with an overall average of nine taxa per station. September and October ranked highest in variety at most stations with overall averages of 12.3 and 11.6 taxa per station respectively.

* Results for June at station 5016 are lacking

Table 3 - Seasonal rankings of abundance and variety of organisms at eight stations in the vicinity of Nanticoke (1969).

RANKING		MONTH			
Abundance		June *	August	September	October
I	(most)	6	0	0	1
II	(next highest)	1	2	3	2
III	"	0	2	3	3
IV	(least)	0	4	2	2
Variety					
I	(most)	3	1	5	4
II	(next highest)	0	1	2	1
III	"	3	0	1	2
IV	(least)	1	6	0	1

* Results for June at station 5016 are lacking

Several species exhibited a significant seasonal variation in numbers as is evident in Table 4. Only those taxa whose monthly ranking in average numbers of organisms corresponded to their ranking at over 50 percent of the stations were considered. A rough indication of the life histories of some macroinvertebrates in the Long Point Bay region is provided by this information. Mayfly larvae were most abundant in the autumn months, emergence as adults taking place in early summer. Larvae of the caddisfly Polycentropus were most numerous in September, the low summer numbers being attributed to emergence.

Numbers of the midge Cryptochironomus and the amphipod Gammarus peaked in early June.

Table 4 - Macroinvertebrates varying seasonally at Nanticoke (1969) (average numbers per station).

ORGANISMS	June	August	September	October
Stenonema spp.	4	2	9	22
S. tripunctatum	< 1	0	3	2
Polycentropus	2	< 1	14	7
Cryptochironomus	13	2	< 1	0
Gammarus fasciatus	336	39	71	31
Physa	2	< 1	2	9
Planariidae	27	22	106	95

Variation Between Stations

To qualitatively compare benthic associations from station to station, the coefficient of similarity was utilized. This treatment of the data provides an indication of the degree to which the species composition at one station is similar to that at another station. As illustrated in Table 5, the coefficients were high and the species composition was relatively similar between stations. However, coefficients for station 518 were substantially lower (below .70) than those for other stations in four out of seven comparisons. The mayfly Ephemerella, the beetle Stenelmis and the isopod Lirceus rarely were

found elsewhere in the sampling grid. Depth, currents and water quality are only a few of the several possible explanations for this disparity.

Table 5 - Degree of similarity in species composition of bottom fauna among eight stations in the Nanticoke region (1969) using the coefficient of similarity.

Station							
994	.74	.74	.85	[.67]	.74	.78	.88
5008	.72	.85	.90	.82	.72	.82	
5016	.79	.80	.79	.72	.79		
810	.75	.76	[.69]	[.68]			
518	[.68]	[.69]	.79				
648	.74	.81					
112	.81						
501							
	501	112	648	518	810	5016	5008	994

Coefficient of similarity (between stations A & B) $= \frac{2 \text{ (taxa common to stations A \& B)}}{\text{number of taxa at A + number taxa at B}}$

Quantitative information from two stations was markedly different from that at other stations. At station 5016, populations of flatworms (Planariidae) and the snail Bulimus tentaculatus exceeded the monthly average numbers of these organisms at all stations by at least three and six times respectively. Their increased population densities are possibly related to the discharge of organic material

from Nanticoke Creek. Station 648 was consistently the least productive station, its monthly total number of organisms ranging between 44 and 59 during the entire sampling interval. Consequently, its annual average number of organisms (53) was roughly one fifth the overall average (259).

CONCLUSIONS

1. The number of different macroinvertebrate taxa found at the eight stations in 1969 totalled 31.
2. The number of taxa per station ranged from 15 to 20 in 1969.
3. The annual average number of organisms per station was 259, ranging from 53 to 833.
4. Benthic associations varied seasonally both qualitatively and quantitatively.
5. The degree of similarity in species composition among stations was quite high with the exception of station 518 in the majority of comparisons.
6. A consistently high number of organisms at station 5016 indicated that it was likely effected by Nanticoke Creek. Consistently low numbers of organisms at station 648 are unexplained.

APPENDIX I - Macroinvertebrates and fish collected from Long Point Bay at eight stations in the Nanticoke area in June, August, September and October, 1969. Numbers indicate average number of organisms collected from two artifical substrates at each station.

ORGANISMS	STATION 994				STATION 5008				STATION 5016				STATION 810			
	J	A	S	O	J	A	S	O	J	A	S	O	J	A	S	O
MAYFLIES																
Ephemerella					1											
Stenonema spp.	12	8	10	9	10	8	13	21			1	5	4		10	53
S. tripunctatum	1		10	2			2	5				1			2	3
CADDISFLIES																
Athripsodes																1
Polycentropus	6	1	42	20	2		16	4		1	2		1		31	16
BEETLES																
Stenelmis																
MIDGES																
Cryptochironomus	56	2	1		4	2				3			30	2	2	
Dicrotendipes			1												1	
Microtendipes											1					
Tanytarsus			1													
pupae	7												1			
ISOPODS																
Asellus militaris			2		1	1				5	9	40	1	2	2	3
Lirceus sp.																
AMPHIPODS																
Crangonyx			2													
Gammarus fasciatus	270	44	32	10	517	83	18	49		29	417	85	183	22	39	12
Hyallela azteca		1														
Pontoporeia affinis																
DECAPODS																
Cambarus robustus							1									
Orconectes propinquus	5	4	4	4	3	2	4	4		2	2		7	2	6	7

Appendix I - continued

ORGANISMS	STATION 994				STATION 5008				STATION 5016			STATION 810			
	J	A	S	O	J	A	S	O	J	A	S	O	J	A	S	O
CLAMS																
Pisidium															1	
Sphaerium		1						1		1	1				3	
SNAILS																
Amnicola			1	1				3				1				
Bulimus tentaculatus		2			7	5	5	4		123	228	43	12	9	39	4
Goniobasis		1	2		4	8	7	2		1	1			4	8	3
Helisoma												1			1	
Physa	1			6	1			4			3	4	1			1
Somatogyrus										1						
Valvata tricarinata (immatures)											34	63			2	
FLATWORMS																
Planariidae	1	13	13	3	1		2	6		65	708	608	22	44	41	10
LEECHES																
Glossiphonia										1					1	
Helobdella													1			
WORMS																
Limnodrilus (imm.)															1	
FISH																
Sculpins			4	1	1	1	1	2		4	2	4		1	2	2
TAXA	8	10	14	9	12	8	10	12		12	12	10	10	8	17	12
ORGANISMS	359	77	125	56	552	110	69	105		236	1409	855	263	86	192	115

Appendix I - continued

ORGANISMS	STATION 518				STATION 648				STATION 112				STATION 501			
	J	A	S	O	J	A	S	O	J	A	S	O	J	A	S	O
MAYFLIES																
Ephemerella				1												
Stenonema spp.	3	1	34	79	1		1	3				1			1	
S. tripunctatum	1		8	4				1								
CADDISFLIES																
Athripsodes				1												1
Polycentropus	1		9	5	1		9	4		1	1	1			1	2
BEETLES																
Stenelmis		1														
MIDGES																
Cryptochironomus	1		1		1					8	1		1		1	
Dicrotendipes																
Microtendipes															1	
Tanytarsus																
pupae																
ISOPODS																
Asellus militaris						2	1	1	5	2	4	42	16	1	10	15
Lirceus sp.		1	1	2									1			
AMPHIPODS																
Crangonyx						1	3							1	1	
Gammarus fasciatus	120	68	17	6	27	35	8	5	306	3	24	18	920	30	13	64
Hyallela azteca																
Pontoporeia affinis														1		
DECAPODS																
Cambarus robustus	1			1	1				1							
Orconectes propinquus		4	3	2	3	3	5	6	4	2	2	1	7	2	1	1
CLAMS																
Pisidium									1					1		
Sphaerium									1		1		1	1		

Appendix I - continued

ORGANISMS	STATION 518 J	A	S	O	STATION 648 J	A	S	O	STATION 112 J	A	S	O	STATION 501 J	A	S	O
SNAILS																
Amnicola				10				1				2				2
Bulimus tentaculatus	5	15	8	10		2		1	1	1	2	1	50		1	3
Goniobasis	5	26	14	14	15	14	9	13	1		3	1	2			
Helisoma											1	1	4			1
Physa				29	1	1	11	8	1		1	3	8		3	13
Somatogyrus																
Valvata tricarinata									1							
(Immatures)				32	9		1		1		1					
FLATWORMS																
Planariidae	2	1	10	23			1		30	44	52	60	130	7	24	52
LEECHES																
Glossiphonia				1												
Helobdella																
WORMS																
Limnodrilus (imm.)																
FISH																
Sculpins		1	4	4				1	1	1	2	1	2	4	5	4
TAXA	10	9	11	16	8	7	9	11	12	8	12	12	12	9	12	11
ORGANISMS	141	118	109	224	59	58	49	44	354	62	95	132	1142	48	62	158